Swami Ramanand Teerth Marathwada University, Nanded

SUBMISSION OF THE Ph.D. REGISTRATION

SYNOPSIS ON

" A Novel Approach-Based Classification For Object Identification Using Digital Image Processing"

UNDER THE

FACULTY OF SCIENCE AND TECHNOLOGY

IN THE SUBJECT OF

COMPUTER SCIENCE

SUBMITTED BY

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UNDER THE GUIDANCE OF

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1.Introduction :

The field of digital image processing refers to processing digital images by means of a digital computer. The digital image is composed of a finite number of elements, each of which has a particular location and value. These elements are referred to as picture elements, image elements, pels, and pixels. Pixel is the term most widely used to denote the elements of a digital image. A digital image is defined as a two-dimensional function f(x, y), where x and y are spatial (plane) coordinates, and the amplitude of f at any pair of coordinates (x, y) is called the intensity or gray level of the image at that point. When x, y, and the amplitude values of f are all finite, discrete quantities, we call the image a digital image.

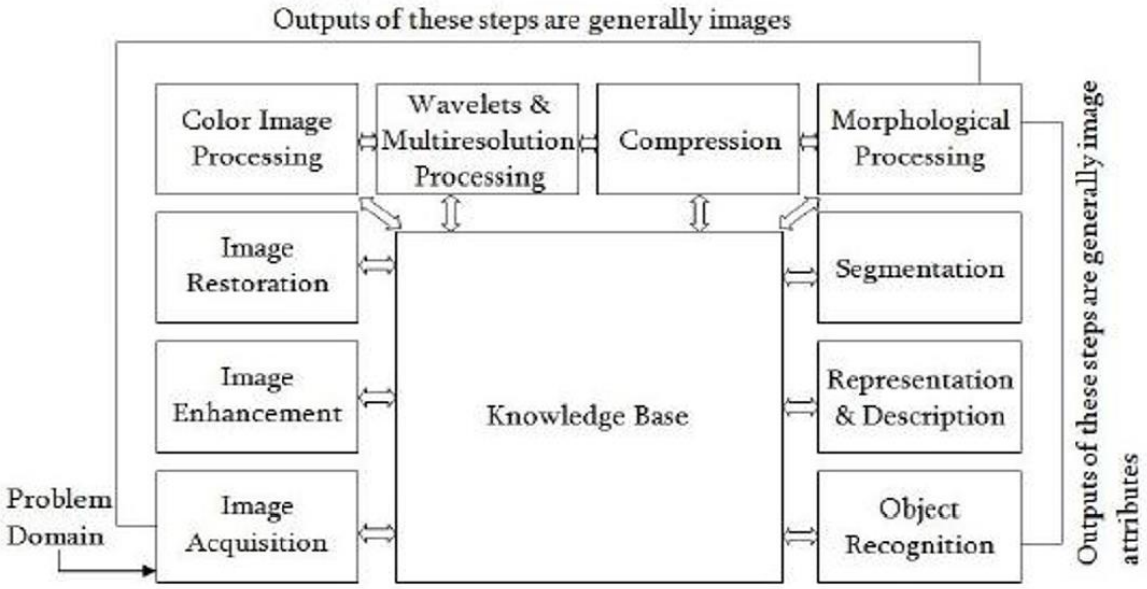

Fig1: Fundamental steps of Digital Image Processing

In above diagram various fundamental steps of digital image processing are shown.

In this study we are applying digital image processing technique on dental images. The digital images are the most important medium for carrying the information in the field of image mining.

2.Review of Literature :

Image segmented methods are very useful in image processing applications.

Shah Alam, Malaysia "Detection Comparison of Hybrid Feature Extraction for Combustible Fire Segmentation: A Canny vs Sobel Performance Analysis" 2020 11th IEEE Control and System Graduate Research Colloquium (ICSGRC 2020), 8 August 2020

In this paper, author says that fire is a dangerous environmental problem; putting the fire out in an incident area cannot be done without fire prevention equipment. Fire prevention equipment means any device, appliance, or machinery intended for use, and examples of this are fire extinguisher, fire alarm, and smoke alarm. Therefore, fire detection is very crucial for the safety of humans. Detecting the fire is one of the main matters in the security system. It proves that using Canny edge detection getting 98% accuracy more accurately than the Sobel edge detection technique. This paper showed different types of algorithms in image processing. It uses the RGB (Red, Green, and Blue) Color Model and HSV conversion to extract features of fire. Edge detection applying Sobel which has two separate directions – the vertical and the horizontal. Canny edge detection that spots edges with noise suppressed at the same time. [2] [13] Canny also detects a wide variety of edges in images. The algorithm of feature extraction of fire was validated and has a validating f-score of 0.98 using Canny Edge Detection and segmentation.

"An Image Edge Detection Method Based on Haar Wavelet Transform" 2020 International Conference on Artificial Intelligence and Computer Engineering (ICAICE) Beli ceu cui Hao Jiang

In this paper author proposed an edge detection method using Haar Wavelet Transform. A clear edge image is the basis of many other applications like face recognition, license plate recognition. In this study, we. Firstly, we pre-process the image by extracting the Y channel of the image. Secondly, we remove the image's noise. Then we perform step 3, Haar Wavelet Transform and post processing. [3][9] Finally, Otsu Threshold Segmentation is used to help us binarize the image in order to acquire the detection result. We use human face and skyscrapers as examples to visualize our method and ROC curve to evaluate our method. The experimental result validates the effectiveness of method and find that Haar Wavelet Transform can still generate a quite accurate and linear edge even with noised image. Utilizeing an adaptive wiener filter for the noise removal. Finally by applying Haar Wavelet Transform and obtain the final output image by steps Absolute magnitude image and Otsu Threshold Segmentation. Then, we carry out a performance evaluation based on Receiver operating characteristic (ROC) curve. Based on the simulation results, &finally concluding that the proposed edge detection method surpasses several existing methods in clarity and denoising degree.

Research on Image Edge Detection Method Based on Improved Robinson Operator and Ots Algorithm Proceedings of 2020 IEEE International Conference on Mechatronics and Automation October 13 - 16, Beijing, China

In this paper, author proposed an edge detection algorithm based on the improved Robinson operator and neighbourhood mean weighted maximum inter-class variance threshold selection. Robinson operator is mainly improved from two aspects. Firstly, the large computation is reduced by reducing the number of templates of Robinson operator; secondly, in the process of threshold selection, the threshold segmentation algorithm based on neighbourhood mean weighted maximum inter-class variance of [4][10] gray histogram is adopted to determine
the optimal threshold for edge detection. The experimental results show that the improved optimal threshold Robinson operator is used for edge detection, which overcomes the shortcomings of the traditional Robinson operator, such as low edge detection efficiency and rough edge, makes the edge positioning more accurate and continuous, has strong ability to suppress noise, improves the speed of edge detection. Robustness of the method is very good, which provides a good reference for practical application and has certain practical significance. Then, by improving the classical maximum inter-class variance method, a threshold segmentation algorithm based on the mean weighted maximum inter-class variance in the neighbourhood of gray histogram is proposed, this algorithm improves the accuracy and enhances the noise resistance by weighting the neighbourhood mean of the maximum inter-class variance method. Experimental results show that the proposed new algorithm improves the speed and accuracy of edge detection compared with classical Otsu methods.

Different Image Segmentation Techniques for Dental Image Extraction Int. Journal of Engineering Research and Applications ISSN : 2248-9622, Vol. 4, Issue 7(Version 4), July 2014, pp.173-177

In this paper author introduced that Image segmented methods are very useful in image processing applications.[5] Author proposed a comparative study of three image segmented techniques: region based, texture based, edge based.

i. Based on area dental work: In region-based method area for minute detail is considered. So that the area in region based is larger as the total area is considered. The results obtained by texture method similar when compared to other methods but the one advantage is that it can be implemented to color images. Compared to three methods edge-based segmentation gives better results.

ii. Based on distance between DWs: In region-based method the area, which is considered may be varied accordingly the distance between DW also varies. This gives the advantage of detection of any minute abnormalities in dental images. In both texture and edge methods the distance between DW same as existing methods.

iii. Based on angle between DWs: In all the methods the angle is same as existing method

Comparing three proposed methods, Region: Gives the freedom for selecting the area of minute detail for dental process. Texture: This method can be implemented for color images and helps when bleeding occurs in dental process. Edge: This is the best method when compared with the above methods as area and angle between DW is accurate

Image segmentation is the process of partitioning a digital image into multiple segments and often used to locate objects and boundaries (lines, curves etc.). In this paper, author proposed image segmentation techniques: Region based, Texture based, Edge based. These techniques have been implemented on dental radiographs and gained good results compare to conventional technique known as Thresholding based technique. The quantitative results show the superiority of the image segmentation technique over three proposed techniques and conventional technique.

Nilesh K. Deshmukh, Ajay B. Kurhe, Suhas S. Satonkar "Edge Detection Technique for Topographic Image ofan Urban / Peri-Urban Environment Using Smoothing Functions and Morphological Filter "(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 2 (2) , 2011, 691-693

In this paper author proposed Canny edge detector best performance both visually and quantitatively based on the measures such as mean square distance, error edge map and signal to noise ratio. This paper considers the morphological open function with 3 X 3 square structural elements for localisation of the detected edges. Canny edge detector algorithm analyses the shape of a smoothing function affects the localisation of detected edges. [6] [14]Using the implemented Canny edge detector as an enhancement tool for topographic images, the result was robust and achieved a very enhancement level.

Image Segmentation Methods: A Comparative Study International Journal of Soft Computing and Engineering (IJSCE) ISSN: 2231-2307, Volume-3, Issue-4, September 2013

This paper concentrates on the idea behind the basic methods used. Image segmentation can be broadly be categorized as semi-interactive approach[12] and fully automatic approach and the algorithms developed lies in either of these approaches. Image segmentation is a crucial step as it directly influences the overall success to understand the image.

New Method Based on Multi-Threshold of Edges Detection in Digital Images (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 5, No. 2, 2014

This paper shows the new algorithm based on the Shannon entropy for edge detection using histogram of the image. The best edge representation and minimize the computation time. A set of experiments in the domain of edge detection are presented. An edge detection performance is compared to the previous classic methods, such as, LOG, Prewitt, Roberts and Sobel. Analysis show that the effect of the proposed method is better than those methods in execution time, also is considered as easy implementation. The significance of this study lies in decreasing the computation time with generate suitable quality of edge detection. In this way entropic edge detector presented in this paper uses Shannon entropy with multi threshold values. Edges characterize object boundaries in image and are therefore useful for segmentation, registration, feature extraction, and identification of objects in a scene. Edges detection is used to classify, interpret and analyze the digital images in a various field of applications such as robots, the sensitive applications in military, optical character recognition, infrared gait recognition, automatic target recognition, detection of video changes, real-time video surveillance, medical images, and scientific research images. [8][12] There are different methods of edges detection in digital image. Each one of these methods is suited to a particular type of images. But most of these methods have some defects in the resulting quality. Decreasing of computation time is needed in most applications related to life time, especially with large size of images, which require more time for processing. Threshold is one of the powerful methods used for edge detection of image. In this paper, We propose a new method based on different Multi-Threshold values using Shannon entropy to solve the problem of the traditional methods. It is minimizing the computation time. In addition to the high quality of output of edge image. Another benefit comes from easy implementation of this method.

3.Objectives:

- To study various existing methodologies available for segmentation parameter classification.
- To design and develop a new effective and efficient algorithm for object identification
- To verify database collection of images by applying proposed Digital image processing tool on it.

4.Proposed Methodology :

In this study we are applying following steps in proposed methodology.

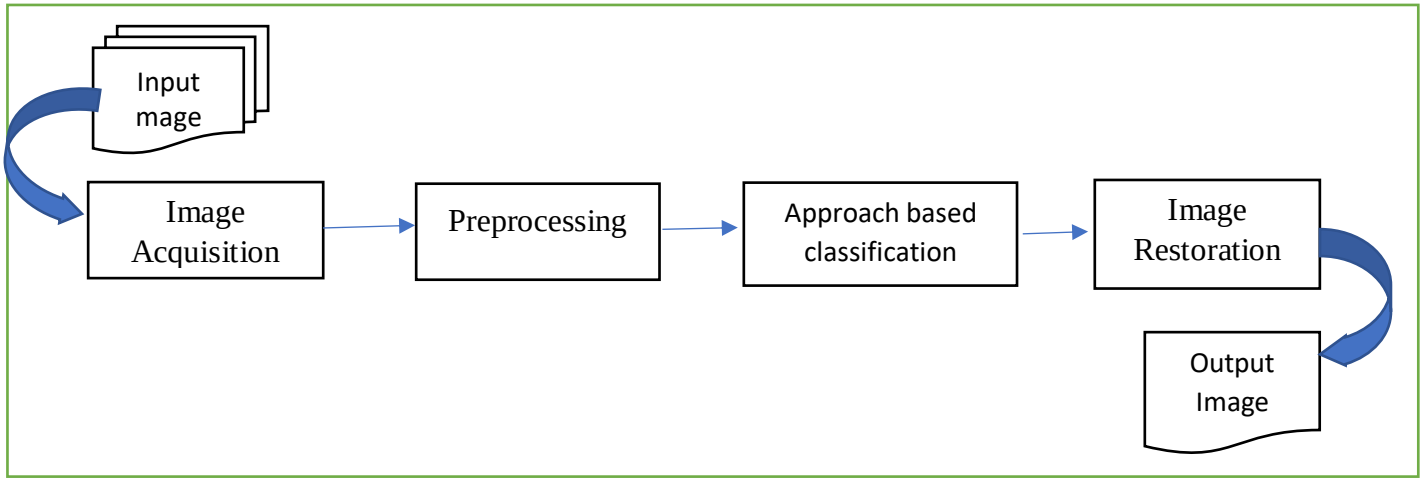

Fig 2: Workflow of Proposed Methodology

The process of analysis using digital image processing can be divided into various phases. The blocks diagram of proposed system is shown in Fig 2. Following are the steps of proposed methodology we are applying for dental image processing.

1.Image Acquisition : It is the first step or fundamental step of digital image processing. Under image acquisition the image is given in digital format. Generally, this stage of image acquisition stage involves preprocessing, such as scaling etc. An image can be acquired by some sort of scanner, digital cameras.

2. Pre-processing : Pre-processing operations are required to be performed on the input image. The aim of pre-processing techniques is to improve the image data to suppress the unwanted distortions and to enhance some features of the input image.

In this study the digital dental x ray images are converted into grey scale image, because less information is needed to be provided for each pixel. As high resolution images, the image size is needed to be reduced because of the reason that processing on high resolution images takes a longer time. Because grey color is the one in which the red, blue and green components contain equal intensities; therefore, it is necessary to specify a single value of intensity level for each pixel

3.Approach Based Classification: Following are the parameters Classifying image segmentation Approach based classification & Technique-Based Classification.

Approach based classification can classify image segmentation methods based on the way algorithms identify objects, which means, collecting similar pixels and separating them from dissimilar pixels. There are two approaches to performing this task:

a) Region-based Approach (Detecting Similarity)

In this method, detecting similar pixels in the image according to a selected threshold, region merging, region spreading, and region growing. Clustering and similar machine learning algorithms method to detect unknown features and attributes. Classification algorithms follow this approach for detecting features and separating image segments according to them.

b) Boundary-based Approach (Detecting Discontinuity)

The boundary-based approach is the opposite of the region-based approach for object identification. Unlike region-based detection, finding pixels having similar features, find pixels that are dissimilar to each other in the boundary-based approach. Point Detection, Edge Detection, Line Detection, and similar algorithms follow this method where they detect the edge of dissimilar pixels and separate them from the rest of the image accordingly.

c) Technique-Based Classification

Both of the approaches have their distinct image segmentation techniques. We use these techniques according to the kind of image we want to process and analyze and the kind of results we want to derive from it.

Based on these parameters, we can divide image segmentation algorithms into the following categories:

1) Structural Techniques

These algorithms requiring the structural data of the image that are using. This includes the pixels, distributions, histograms, pixel density, colour distribution, and other relevant information. Then, must have the structural data on the region & that have to separate from the image.

2) Stochastic Techniques

These algorithms require information about the discrete pixel values of the image, instead of the structure of the required section of the image. Machine learning algorithms such as K-means clustering and ANN algorithms fall in this category.

3) Hybrid Techniques

In this technique use both stochastic and structural methods. This means useing the structural information of the required region and the discrete pixel information of the whole image for performing image segmentation.

4. Image Restoration: Image restoration is an area, in which the appearance of an image is improved. Image restoration techniques are based on mathematical models or probabilistic analysis of an image. There are various filter available or can be designed for the restoration and to enhance the quality of an image. By applying various image processing techniques accompanied with edge detection on digital image, the object of interest from the given image can be obtained.

Image Segmentation Technique

Image Segmentation has a very important role in medical imaging. It is a process of dividing the image into multiple parts, which are used for identifying objects and other relevant information. Image Segmentation is partitioning a digital image into multiple segments and it is often used to locate objects and boundaries. It is the process of assigning a label to every pixel so that every pixel with the same label has common characteristics

Edge detection is a fundamental tool for image segmentation. Edge detection methods transform original images into edge images benefits from the changes of grey tones in the image. Following are the edge detection technique. In this study we are using that edge detection technique.

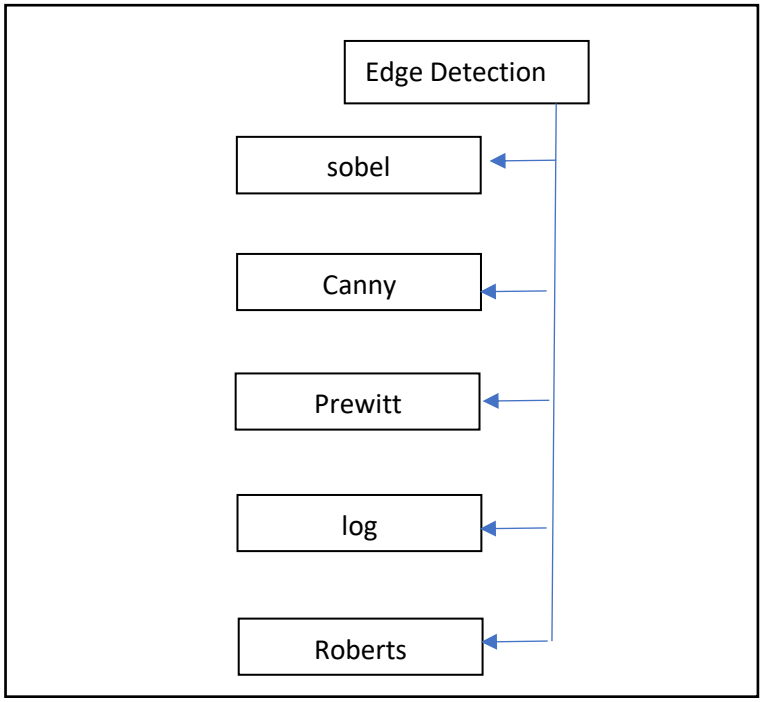

Fig 3: Edge Detection Technique

1.**Sobel edge detection technique**: Sobel edge detection method is introduced by Sobel in 1970 (Rafael C.Gonzalez (2004)). The Sobel method of edge detection for image segmentation finds edges using the Sobel approximation to the derivative. It precedes the edges at those points where the gradient is highest.

2. **Canny edge detection technique** : Canny edge detection technique is one of the standard edge detection techniques. It was first created by John Canny for his Master's thesis at MIT in 1983, and still outperforms many of the newer algorithms that have been developed. To find edges by separating noise from the image before find edges of image the Canny is a very important method.

3. **Prewitt edge detection technique** : Prewitt edge detection technique is proposed by Prewitt in 1970 (Rafael C.Gonzalez [1]. To estimate the magnitude and orientation of an edge Prewitt is a correct way. Even though different gradient edge detection wants a quite time-consuming calculation to estimate the direction from the magnitudes in the x and y-directions, the compass edge detection obtains the direction directly from the kernel with the highest response.

4. **Laplacian of Gaussian (LoG) technique** : Laplacian of Gaussian (LoG) technique was proposed by Marr(1982). The LoG of an image f(x,y) is a second order derivative. It has two effects, it smoothes the image and it computes the Laplacian, which yields a double edge image.

5.**The Roberts edge detection technique** : It is introduced by Lawrence Roberts (1965). It performs a simple, quick to compute, 2-D spatial gradient measurement on an image. This method emphasizes regions of high spatial frequency which often correspond to edges. The input to the operator is a grayscale image the same as to the output is the most common usage for this technique. Pixel values in every point in the output represent the estimated complete magnitude of the spatial gradient of the input image at that point.

5. Importance of Study:

i) International Status:

Image segmentation has become a popular area of research. Image segmentation is a large aspect of computer vision and has many applications in numerous industries Face Recognition Number Plate Identification Image-Based Search.

ii) Significance of the Study:

A lot of research work is carried out in the segmentation technique. Studies on segmentation & restoration technique published from many parts of the world show a distinct variation. In India we find that very few people are contributing the relative frequency of edge detection technique in an Indian teaching hospital.

6.Proposed work Plan:

Year-wise Plan of work and targets to be achieved:

I.2021-2022 :

- Collection of Research Papers
- Complete Course Work.
- Study of MATLAB software.

II. 2022-2023:

- Database collection
- Study of Methodology
- Preparation & Publication of research papers.

III. 2023-2024:

- Study of soft computing techniques.
- Segmentation techniques implemented in MATLAB software.
- Test development of testing algorithms in different circumstances.

7. Conclusion:

Image processing is used to extract some useful information to the image or operates on an image to get an enhanced image. Image segmentation has a promising and challenging future as the universal segmentation algorithm. Edge detection is widely popular because it helps removing unwanted and unnecessary information from the image. It reduces the image's size considerably, making it easier to analyse the same.

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Research Student **Signature of the Guide**

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